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ROMANES ON WEISMANN.

An Examination of Weismannism. By G. J. Romanes, M.A., LL.D., F.R.S. (London: Longmans, Green, and Co., 1893.)

DR. ROMANES is a most competent hurler of hard words, and in this volume is concerned at least as much to convince the reader that Weismann is an uncertain guide as to be to him himself a certain guide. In the preface he states his intention to publish his criticisms "in separate form and in comparatively small editions, so that further chapters may be added with as much celerity as Prof. Weismann may hereafter produce his successive works." In the text, writing of the relations between the views of Galton and Weismann, he talks of those immense reaches of deductive speculation, which, in his opinion, merely "disfigure the republication of stirp under the name of germ-plasm" (!) The mention of certain occurrences which are believed in by Dr. Romanes, but the admission of which he considers illogical on the part of Weismann, "seemed attributable to mere carelessness on the part of their author." Another consideration is "made by Weismann for the sole purpose of saving as much as he can of his previous theory of variation." Another is "an obvious equivoque." The mechanism of heredity is planned out (in Weismann's latest volume) "in such minuteness of detail and assurance of accuracy that one is reminded of that which is given by Dante of the topography of the Inferno."

Of the actual criticism the last chapter and the two appendices alone require special treatment, as they alone were written after the publication of "Amphimixis" and "The Germ-plasm."

It does not seem useful to insist with Dr. Romanes that the continuity of the germ-plasm is the inverse of the basis of the theory of pangenesis. The most important part of the continuity theory has no parallel in Darwin's provisional hypothesis. It is the attractive suggestion of a material basis of heredity which can be identified with structures visible under the microscope; which can be seen, in some cases, to separate immediately from the fertilised ovum to form the foundation of the germ-cells of the new individual, or, in other cases, to move along "germ-tracts" to the foundation of the germ-cells of the new individual. What is directly comparable in the two theories is the picture each gives of the phenomena of inheritance viewed in pangenesis as a rolling up of gemmules from an existing body to form germ-cells; in the germ-plasm as the unrolling of germ-plasm to form a developing body. In this, as Dr. Romanes points out, the one theory is the inverse of the other, and very naturally similar groups of facts may appear in the one as stages of rolling up, in the other as stages of disintegration. But here again Weismann, aided no doubt by the vast advance in microscopical science, constantly is more in touch with observed facts of microscopical detail than was Darwin.

Dr. Romanes uses a good deal of space for a minute and interesting comparison of Weismann's germ-plasm with the "stirp" of Galton. He urges that natural selection, so potent in the organic world, probably does not cease in the separate parts of a body during development, and therefore supports Galton's view of a competition among many gemmules of the same order as to which shall actually cause development. But natural selection is not a force: it is merely an aspect of certain occurrences, and while there may be many (as Galton thinks) or few (as Weismann thinks) units of germ-plasm each capable of causing development, and only one of which does cause development, the aspect of the occurrences on which Weismann wishes to direct attention is that the process of development goes on by an orderly disintegration of the germ-plasm through various stages of units, and that the order is determined by the "historic architecture" of the germ-plasm. This "historic architecture" is the material representation (on Weismann's theory) of the observed fact that ontogeny does to some extent repeat phylogeny. A continual struggle among innumerable units would account for too much variation, and would leave unrepresented the habitual fixedness of heredity.

In his criticism of Weismann's view of evolution Dr. Romanes first states how recent further investigations (those of Maupas and others) into the conjugation of Protozoa have led to an identification of conjugation with sexual reproduction, so far as they both result in a mingling of germ-plasm, but he quarrels with Weismann for not abandoning the potential immortality of the Protozoa. But whether Protozoa conjugate or not, on the broad average they divide by fission. That means that Protozoa alive to-day have come down in a continuous chain of cell-life from primeval Protozoa, unless indeed there have been continual re-creations of Protozoa. Even if it were proved that spore-formation invariably interrupted at long or short intervals chains of simple fission, still practical immortality may be held by regarding spore-formation as merely multiple fission.

In a more important criticism Dr. Romanes seems to me to misinterpret Weismann's position. When the continuity of germ-plasm first presented itself to Weismann's mind, and brought with it the idea that the somas of each generation were mere pendants of the chain of germ-plasm, it became difficult to see how the impression of outside nature on the soma could be impressed in turn on the germ-plasm. This led to an examination of a new kind into acquired characters, and the result of that examination satisfied Weismann and many others that there was no sufficient reason for supposing that characters acquired by the individual were transmitted to the progeny. Of course this is still a matter of argument, and as Dr. Romanes in this book refers to a full treatment of the question, the publication of which has been delayed by his regrettable illness, it may well be that he will adduce fresh and important considerations. But the fact remains that Weismann, driven back from acquired characters as a cause of phylogenetic variation, came to regard the mingling of germ-characters in amphimixis (traceable back to the direct influence of the environment upon organisms antecedent to amphimixis) as the source of all variation. The germ-plasm lived as a parasite within the soma, and was related to it only by the fact that it got food from the soma. In the more developed doctrine

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Weismann retains the original conception. But the germ-plasm is now a particulate substance, and *inequalities of nutrition affecting the separate elements cause variations in it.* The original conception has now become more definite, and this increase in definition has effected a reconciliation with some strong objections to the generalised idea. It seems to me extraordinary that a critic so acute as Dr. Romanes, not in the heat of controversy but in a deliberate book, should call this "removing stone by stone, his doctrine of descent," and "turning upside down the fundamental postulate." In order to reach such a view he has had to be much more certain than Weismann, about what Weismann meant, and to attribute to "mere carelessness" the inclusion in Weismann's earlier writings of indications pointing in this direction.

In Appendix I. the germ-plasm is discussed specially in so far as Weismann considers pangenesis a less conceivable and a more formal explanation. I think the key to the criticism is again to be found in a misconception by Dr. Romanes. He quotes from Weismann:—

> "How can such a process (*i.e.* the passage of gemmules into growing germ-cells) be conceivable when the colony becomes more complex, when the number of somatic cells becomes so large that they surround the reproductive cells with many layers, and when, at the same time, by an increasing division of labour, a great number of different tissues and cells are produced, all of which must originate *de novo* from a single reproductive cell?"

He goes on:—

> "Here again the obvious answer is that no one has ever propounded such a statement. Far from supposing that 'all the different cells and tissues of a complex organism must originate *de novo* from a *single* reproductive cell,' the theory of pangenesis supposes the very contrary—viz. that somatic changes in the past history of the phyla had *not* thus originated in *any* reproductive cell. The idea of somatic changes originating in reproductive cells belongs to the theory of *germ-plasm;* but even this theory does not suppose all the great number of different cells and tissues which compose a complex organism to have ever originated *de novo* from a *single* reproductive cell."

What Weismann means seems clear enough, although it is dark to Dr. Romanes. The whole of a complex organism grows out from an ovum, and this origin occurs *de novo* in each generation. Pangenesis supposes that gemmules from each cell in the body somehow come together to form the ovum, and they come together so that they unroll in proper order. For this process there is no trace or shadow of evidence: to many it seems *à priori* inconceivable.

According to Weismann's theory the germ-plasm has been slowly built up in phylogeny, and slowly unrolls in the individual development. On any supposition the process is wonderful: on Weismann's hypothesis the evolution of germ-plasm has actually followed the evolution of living things from simple to complex, and there is no new wonder in its complexity, nor is the unrolling of the historically elaborated germ-plasm more wonderful than the actual development of the historically elaborated soma. The hypothesis of pangenesis supposes that in each living organism there is a new wonder, the giving off of gemmules, and their building up into an ovum which reproduces not only the structures which gave off gemmules, but many an embryonic structure dating far back in phylogenetic history.

Appendix II. deals with Telegony, and practically consists of Dr. Romanes' recent controversy with Herbert Spencer. In the mass of confused data about this subject it seems fairly established that at least it is very rare. The influence of a first sire does not as a rule affect children to a second sire. Herbert Spencer thinks that the established cases are fatal to Weismann's theory, inasmuch as they prove that influences impressed on the soma can be transferred to the offspring. Romanes thinks that they are not fatal, inasmuch as germ-plasm from spermatozoa of the first sire coming in contact with the ovary when a spermatozoon caused impregnation, might, as they disintegrate, allow some of their germ-plasm to penetrate the ovary and reach other ova. The actual explanation seems, to the present writer, a much simpler one, but as he is collecting facts he will only mention it. In the best established cases, as for instance Lord Morton's mare, and the sow quoted by Mr. Spencer, the first sire was of a more ancestral type than the second sire, and the characters in the progeny attributed to the influence of the first sire were atavistic, and in ordinary cases would have been simply referred to as throw-backs. But as at present Dr. Romanes' criticism of Weismann is the matter in hand, it is enough simply to point out that in this most difficult case for followers of Weismann, Saul also is among the prophets—Dr. Romanes agrees with Weismann! P. C. M.

EXTRA-TROPICAL ORCHIDS.

Icones Orchidearum Austro-Africanarum Extra-tropicarum; or Figures, with Descriptions of extra-tropical South African Orchids. By Harry Bolus, F.L.S. Vol. i. Part I. (London: William Wesley and Son.)

THIS is an excellent work, devoted to the orchids of extra-tropical South Africa, and arranged on the lines of the "Refugium Botanicum" of Mr. Wilson Saunders. The first part includes fifty plates, containing figures and dissections (partly coloured) of fifty-one species. The text comprises descriptions in Latin and English, references to original descriptions, synonymy, geographical distribution, with critical and explanatory notes. The author's many years of careful study of South African orchids, as well as his previous writings on the subject, are sufficient guarantee of the quality of the work; and as regards the plates, a decided improvement is noticeable, both in the drawings and lithography, as compared with his previous "Orchids of the Cape Peninsula" (reviewed in NATURE, vol. xxxix. p. 222). The work will be of great use to the systematic botanist, for, as Mr. Bolus has well pointed out, few orders of plants stand more in need of illustration from living specimens than orchids, because of the high degree of specialisation of many of the parts, some of which are very fleshy, and seldom recover their shape after soaking or boiling. Nine new species are described in the present part, *Angræcum caffrum*, *A. Maudæ*, *Habenaria Galpini*, *Satyrium Guthriei*, *S. ocellatum*, *Pachites Bodkini*, *Disa sabulosa*, *D. conferta*, and *Brown*

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